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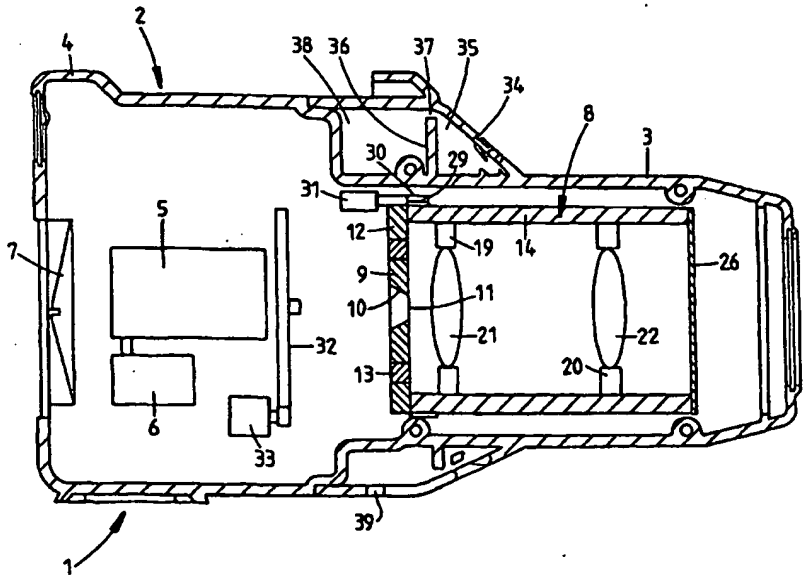
(54) Title: A LIGHT SOURCE



(57) Abstract

A light source (1) includes a lamp (5), an aperture (11) to direct light through a pair of spaced apart focusing lenses (21, 22). An adjustable lens mounting arrangement (8) moves the lenses (21, 22) toward and away from the aperture (11) to focus light output from the light source (1) at different distances. The lens mounting arrangement (8) simultaneously moving each of the lenses (21, 22) at different linear rates.

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A LIGHT SOURCE

Field of the Invention

This invention relates to a compact light source used to provide an illuminating beam for various applications including search and rescue operations, marine vessels, surveillance, border patrols, aircraft search lights, entertainment lighting, train lights and lights for land vehicles in particular emergency services vehicles. The invention is particularly concerned with light sources where high power portability and/or compact size are important. These type of light sources can either be mounted on various vehicles or used in hand-held applications either from mains or from battery power.

Background Art

A desirable feature in light sources of this type is the ability to adjust the beam in use depending upon the application and/or range to the target to be illuminated. Many existing light sources use a reflector arrangement of fixed focal length which results in the beam size being fixed at any given distance. Other known sources provide some limited focusing of the beam by providing for movement of the reflector or use of a focusing lens. The adjustment of the beam is however often limited by the competing considerations of minimising physical device size and weight.

Disclosure of the Invention

This invention provides a light source that includes an optical configuration that allows focusing of the output light beam.

In one aspect this invention provides a light source including a light source including a lamp, an aperture to direct light through a pair of spaced apart focusing lenses, and an adjustable lens mounting to respectively move said lenses toward and away from said aperture to focus light output from the light source at different distances, said lens mounting being arranged to simultaneously move each of said lenses.

Preferably the lens mounting moves each of said lenses at different linear rates.

Preferably the lens mounting utilises helical tracks or guides that have respectively different pitches. The lens mounting are preferably arranged to move the lenses in opposite directions with respect to the aperture. Thus the lenses can either be moved toward or away from each other. The lens mounting preferably has two sets of three parallel helical tracks for movement of each lens. The tracks are preferably equally spaced about the inside surface of a cylindrical drum. Preferably guide pins extending from a lens holder engage the tracks to provide for movement of the lenses along the longitudinal axis of the drum in response to rotation of the drum.

The aperture is preferably disposed within a concave non-reflecting surface directed toward the lamp. The concave surface is preferably of conical or frusto-conical form and is formed from a ceramic. The aperture is preferably 5mm in diameter for the preferred lamp size.

In one form of the invention the light source includes a housing containing an xenon arc lamp and a switch mode power supply to drive the lamp. Preferably the switch mode supply is mounted closely adjacent the xenon arc lamp so as to provide a minimal distance for the transmission of high voltages to the tube. More preferably the power supply is mounted directly adjacent the xenon arc lamp so that the high voltage connection is made directly between the power supply and the tube without the need for substantial transmission wires for the high voltage supply. The switching supply is preferably driven by a microprocessor and provides switching at a frequency above about that could be perceived by the human eye and above that are known to result in inducement of epileptic attacks. This corresponds to a frequency of at least 60 to 80 pulses per second.

The modulated power supply of this invention has been developed to provide an efficiency of conversion of in excess of 90%. This maximises the operation time of the light source from a battery supply.

The light source according to this invention preferably provides for the selective change in colour of the output. This is preferably achieved by putting a rotatable filter

element between the light source and the optics. The rotatable element has various zones that are placed between the light source and the optics that suitably filter the output of the xenon arc lamp to provide the required colour output. Preferably the rotatable element is adjustable by the user of the light source. This can be achieved by a manual mechanical rotating mechanism or preferably by an electric motor and appropriate operating switch.

The housing of this invention includes air cooling for the power supply and xenon arc lamp. Inlet apertures for the air cooling ducts are directed forwardly of the light source, that is in the direction of the output beam. A path is provided through the housing characterised by a baffle which changes the direction of air flow such that any water entering the inlets is deflected by the baffle to outlets in the housing.

One embodiment of the invention will now be described, by way of example only, with reference to the accompanying drawings.

Brief Description of the Drawings

Figure 1 is a perspective view of a light source according to this invention;

Figure 2 is a schematic sectional view of the light source as shown in Figure 1; and

Figure 3 is a sectional view of part of the light source shown in Figure 2.

Figure 4 is a perspective view similar to Figure 3.

Figure 5 is a sectional view along the line A-A of Figure 3.

Figure 6 is a sectional view along the line B-B of Figure 3.

Best mode for carrying out the Invention

As shown in the drawings, the light source of this invention includes a housing 2. The housing includes a forward portion 3 generally cylindrical in shape and a general rectangular rear portion 4. A xenon arc lamp 5 is mounted in the rear portion 4 in connection with a power supply 6. The xenon arc lamp is a 500 watt short arc type lamp which has a life in excess of 1000 hours. Power supply 6 is a switch mode supply directly connected to the xenon arc tube to provide the ignition and operating voltage. The power supply is adapted to receive input power from a portable battery pack (not shown) , a vehicle battery or mains

supply (not shown). A cooling fan 7 of substantially conventional type is mounted toward the rear of the housing 2 to provide cooling of the lamp 5 and power supply 6.

An optical system 8 is mounted largely within forward portion 3. A light output window is provided at the end of forward portion 3. Detail of the optical system is shown in Figures 3 to 6.

The optical system 8 includes a ceramic aperture plate 9 having a conically concave surface 10 with an aperture 11. The aperture plate 9 is mounted in an aperture holding ring 12 by a teflon aperture ring 13. A cylindrical drum 14 is rotatably mounted with the aperture holding ring. The drum 14 is made up of an inner cam sleeve 15 and an outer cam sleeve 16 fixed together. The inner surface of the drum 14 is formed by the inner cam sleeve 15. Two sets of helical tracks 17, 18 are formed in the inner sleeve 15. The set of three parallel helical tracks 17 are formed at one end of the sleeve 15. The set of three parallel helical tracks 18 extend towards the other end of the inner sleeve 15. The set of helical tracks 14 and set of helical tracks 15 are of different pitch and extend in opposite senses.

A lens holder 19 is associated with the set of helical tracks 17 and a lens holder 20 is associated with the set of helical tracks 18. The lens holders 19, 20 respectively mount one of two lenses 21 and 22. The lenses 21, 22 are held in the respective lens holder 19, 20 5by any suitable known technique. Three guide pins 23 are provided on each of the lens holders 19, 20 to engage the associated set of helical tracks 17, 18. Each of the lens holders 19, 20 has three circular apertures 24 spaced around the perimeter. Corresponding guide rods 25 extend through these apertures 24 and are secured to the aperture holding ring 12 at one end and an end plate 26 at the other end. The guide rods 25 prevent rotation of the lens holders 19, 20 within the drum 14 but allow the lens holders 19, 20 to slide along the guide rods 25. Each guide rod 25 is provided adjacent the end plate with a guide roller 26 to support the drum 14 and allow rotation.

Rotation of the drum 14 results in the respective guide pins 23 moving along the associated helical track 17, 18 so as to move the lens holders 19, 20 along the longitudinal

axis 28 of the drum 14. It will be apparent that because the sets of tracks 17 and 18 have an opposite sense rotation of the drum 14 results in the lens holders 19, 20 moving in opposite directions. The respective helical tracks 17, 18 also have a significantly different pitch as will be evident from Figures 3 and 4. The tracks 17 allow for a comparatively shorter movement of lens holder 19 along the longitudinal axis 28 for a given rotation of drum 3. That is, the respective lens holders 19, 20 and the associated lenses 21, 22 thus move at different linear rates in response to rotation of drum 3. The drum is provided with a drive gear 29 which is engaged by a gear drive 30 on motor 31 as shown in Figure 2. Switching and control circuitry (not shown) is provided to activate the drive motor 31 in either the forward or reverse direction and correspondingly rotate drum 14.

The relative positions (in mm) of the center lines of the lenses 21, 22 with reference to the front of the aperture plate 9 is shown in Table 1. By appropriate selection of the lenses this allows the beam to be focused either close to the light source or at a distance.

In use, light from the xenon arc lamp 5 is directed through the aperture 11 to two lenses 21 and 22. Lenses 21 and 22 focus the light to a determined beam size at selected distance.

As shown in Figure 2 a filter wheel 32 is interposed between the xenon arc lamp 5 and optical system 7. The filter wheel 32 includes a range of filter zones (not shown) spaced around the wheel. The colour output of the lamp is adjusted by rotating the wheel 32 to interpose the appropriate filtering element between xenon arc lamp 5 and aperture 11. By using appropriate filters any desired colour including infrared can be selected. A drive motor 33 is provided for the selective rotation of the colour wheel 32.

The housing 2 includes a number of apertures 34 formed at the transition between the forward portion 3 and rear portion 4. These apertures 34 are provided to direct cooling air into the rear 4 of the housing 2 under the action of the rear mounted fan 7. As best seen in Figure 2 the apertures 34 admit air to a first chamber 35 formed between the wall of the housing 2 and a baffle 36. The baffle 36 causes the flow of the air to be changed and passed

through a relatively narrow opening 37 to a further chamber 38 from which it is admitted to the body of the rear 4 of the housing 2. The baffle 36 and restriction arrangement results in any water that enters the forwardly directed apertures 17 not being admitted to further chamber 38 and draining under the action of gravity through drain apertures 39.

Table 1

Lens 1	Lens 2
7.000	153.239
7.500	153.000
8.500	152.515
9.500	152.021
10.500	151.516
11.500	151.000
12.500	150.186
13.500	149.285
14.500	148.290
15.500	147.193
16.500	145.983
17.500	144.651
18.500	143.183
19.500	141.564
20.500	139.800
21.500	137.800
22.500	135.040
23.500	131.942
24.500	128.443
25.500	124.466
26.500	119.900
27.500	114.200
28.500	108.200
29.000	104.898
29.500	101.376

30.000	97.622
30.500	93.600
31.000	88.737
31.500	83.560
32.000	78.000
32.500	71.145
33.000	64.974
33.500	59.276
34.000	53.896
34.500	48.669
34.750	46.009
34.900	45.160
35.000	45.000

The foregoing describes only one embodiment of the invention and modifications can be made without departing from the spirit and scope of the invention.

CLAIMS:

1. A light source including a light source including a lamp, an aperture to direct light through a pair of spaced apart focusing lenses, and an adjustable lens mounting to respectively move said lenses toward and away from said aperture to focus light output from the light source at different distances, said lens mounting being arranged to simultaneously move each of said lenses.

2. A light source as claimed in claim 1 wherein said lens mounting moves each of said lenses at different linear rates.

3. A light source as claimed in claim 1 or claim 2 wherein said lens mounting moves the lenses in opposite directions with respect to the aperture.

4. A light source as claimed in claim 3 wherein the lens mounting includes helical tracks to effect movement of said lenses.

5. A light source as claimed in claim 4 wherein said lens mounting includes at least one first helical track for movement of one of said lenses and at least one second helical track for movement of the other of said lenses, the first and second helical tracks being of different pitch.

6. A light source as claimed in claim 5 wherein said first and second helical tracks are formed on the inside surface of a cylindrical drum and movement of the lenses is effected by rotation of said drum.

7. A light source as claimed in claim 6 a first set of three parallel helical tracks for movement of one of said lenses and a second set of three parallel helical tracks for movement of the other of said lenses.

8. A light source as claimed in any one of claims 5 to 7 including a lens holder for each

of said lenses, each lens holder having one or more guide pins for engagement with an associated helical track.

9. A light source as claimed in claim 6 further including a drive to selectively rotate said drum.

10. A light source as claimed in any one of claims 1 to 9 wherein said aperture is disposed within a concave non-reflecting surface directed toward said lamp.

11. A light source as claimed in claim 10 wherein said concave surface is conical or frusto-conical.

12. A light source as claimed in claim 10 or claim 11 wherein said concave surface is formed from a ceramic material.

13. A light source as claimed in any one of claims 1 to 12 wherein said lamp is an xenon arc lamp driven by a switch mode power supply.

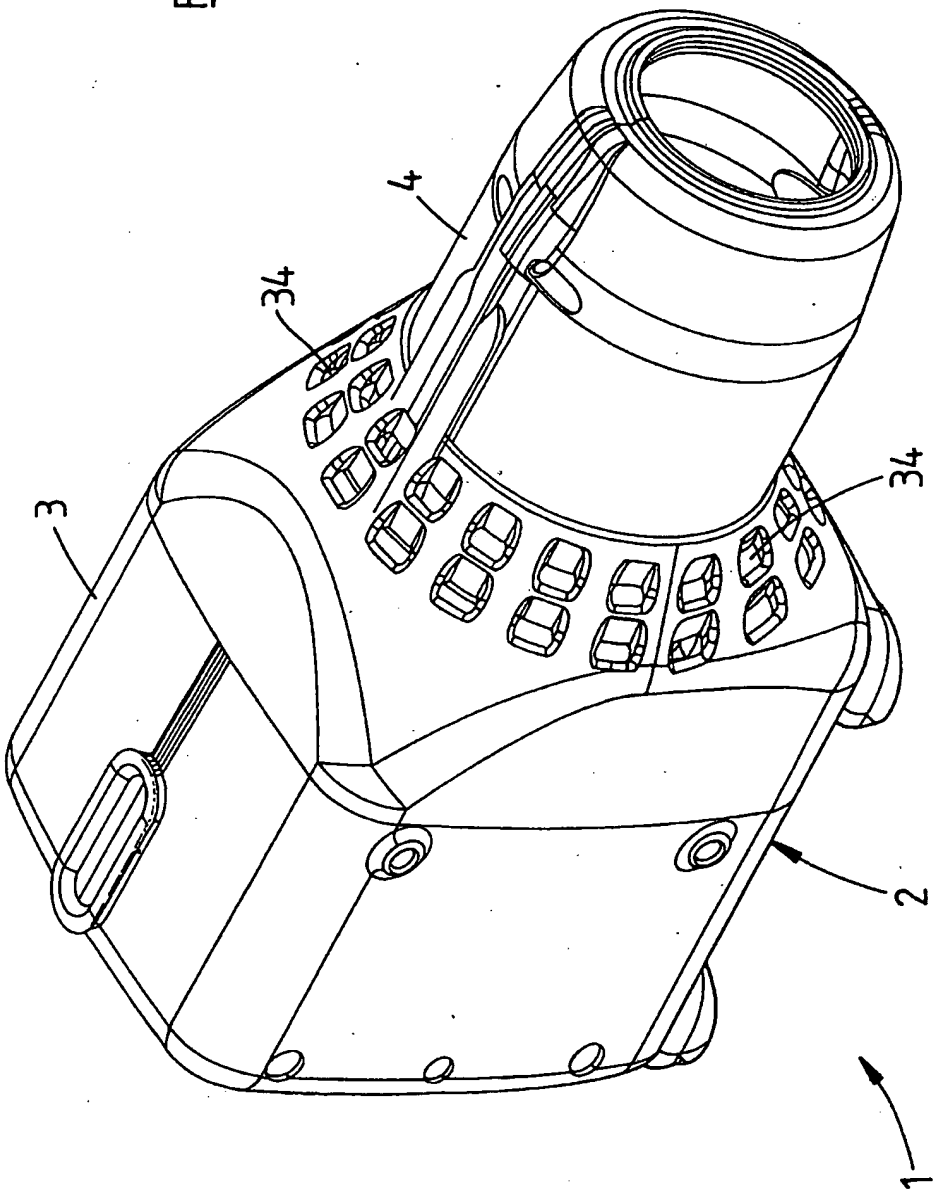
14. A light source as claimed in claim 13 wherein said switch mode supply is mounted directly adjacent the xenon arc lamp and high voltage connection is made directly between the power supply and lamp.

15. A light source as claimed in claim 13 or claim 14 wherein said switch mode supply operates at above a frequency of about 60 pulses per second.

16. A light source as claimed in any one of claims 1 to 15 further including a multiple filter element selectively adjustable to interpose a selected filter between the lamp and said aperture.

17. A light source as claimed in claim 16 wherein said filter is a rotatable element having zones of different filter colours.

FIG 1



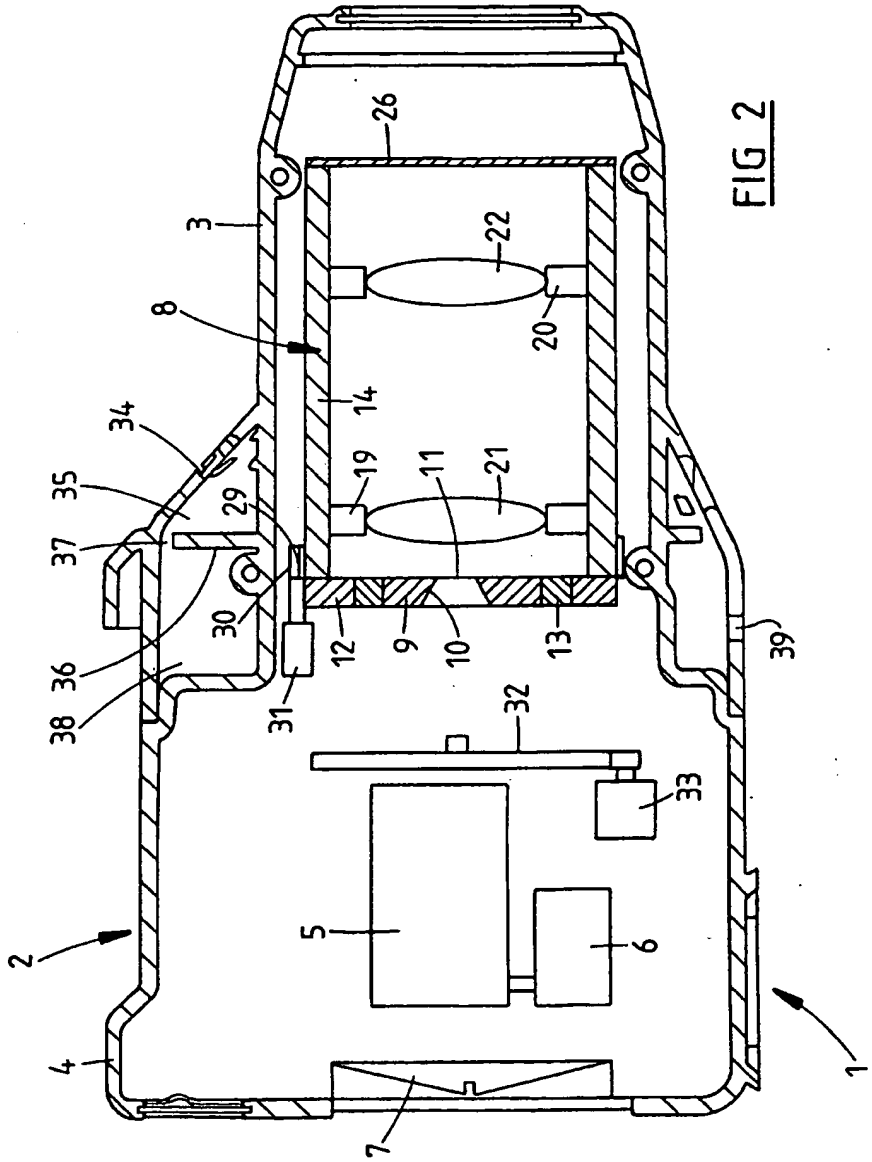

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FIG 2

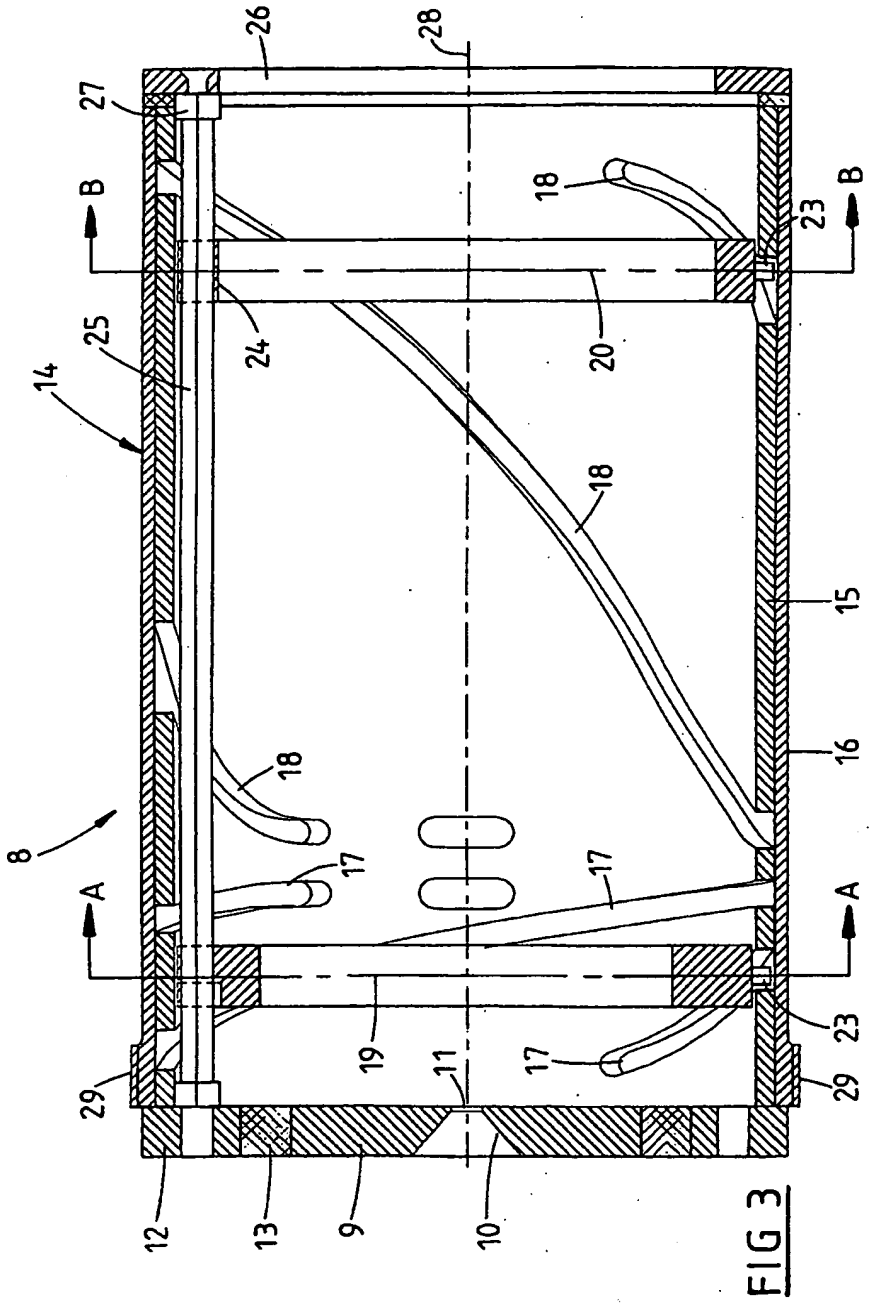
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FIG 3

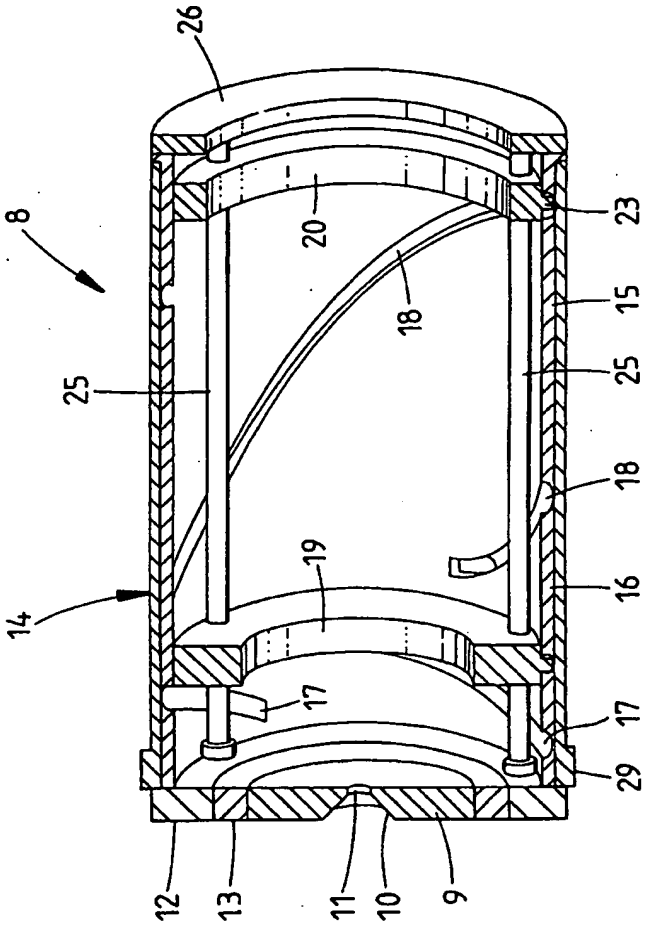

FIG 4

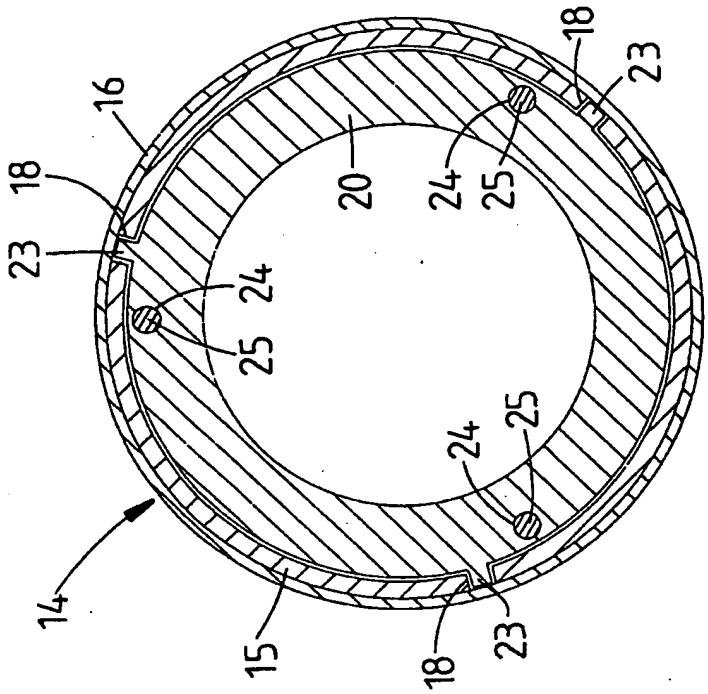
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FIG 6

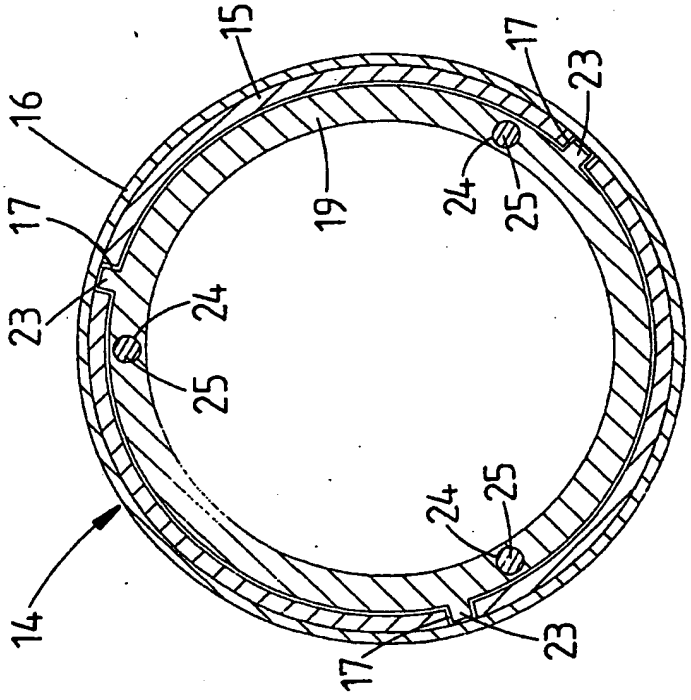
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FIG 5

INTERNATIONAL SEARCH REPORT

International application No.
PCT/AU00/00102

A. CLASSIFICATION OF SUBJECT MATTER

Int. Cl. [1]: F21V 14/06, 17/02, G02B 7/10

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B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC:- F21, G02B 7/-, G03B 21/-

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
AU IPC:- F21V 17/02

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
DWPI, JAPIO with keywords

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X,Y	US 4745531 A (Leclercq) 17 May 1988 See Abstract, col 4 line 56-68, col 6 line 59 to col 7 line 5	1-17
X,Y	US 3594566 A (Kneisley) 20 July 1971 See Abstract, col 1 line 69 to col 2 line 20	1-17
Y	US 4870548 A (Beachy et al) 26 September 1989 Col 4 line 33-45	4-9

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Date of the actual completion of the international search	Date of mailing of the international search report
23 March 2000	28 MAR 2000
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C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	Derwent Abstract accession no. 95-296722/39. Class P81 P82, JP 7192504 A (Ichikoii Ind Ltd) 28 July 1995 See the Abstract	1,10-17
A	US 5584568 A (Corbasson et al) 17 December 1996 See Abstract	

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
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Patent Document Cited in Search Report		Patent Family Member					
US	4745531	AU	58097/86	CA	1260297	EP	208569
		FR	2582780	JP	61288302		
US	5584568	DE	4237386	FR	2683296		

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